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## DATA STORAGE CONTROL APPARATUS FOR A MULTIPROGRAMMED DATA PROCESSING SYSTEM

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### ABSTRACT OF THE DISCLOSURE

A multiprogrammed data processing system wherein separate control apparatus automatically controls the continuous transfer of information between working and auxiliary stores and wherein the control apparatus further automatically controls the type of information transfer being provided, thereby implementing the flow of data at the speed required by the system.

### BACKGROUND OF THE INVENTION

This invention relates to data processing systems and more particularly to apparatus for controlling the transfer of information among the plural stores of a data processing system.

A data processing system including a computer for alternately executing a series of programs which are completely or partially located in a quick-access working store is said to be multiprogrammed. One form of multiprogrammed data processing system comprises at least one computer, a plurality of small capacity quick-access working stores, a relatively large capacity auxiliary store and a plurality of peripheral control units each coupled to at least one peripheral device. In such a multiprogrammed data processing system, the series of programs are executed by the computer as a result of switching between a plurality of programs. The program switching is controlled by an operating system, which is a collection of programs that are executive or supervisory in nature and provide overall coordination and control of the total data processing system. The plurality of programs also include subject programs which are application oriented programs to perform various data processing jobs providing results required by users. In multiprogrammed data processing systems required to execute a large number of programs, the quick-access working store capacity is too costly to be large enough to contain all of the operating system programs, subject programs, data to be processed, and data which is the result of processing. Consequently, only the programs and data most frequently used or currently in process are normally located in working store and the remaining programs and data are located in a relatively large capacity slow-access auxiliary store. As programs and data stored in auxiliary store are required to be executed or processed by the computer, the information must be transferred to the working store at a speed compatible with the data processing capabilities of the computer.

It is necessary to maintain a continuous supply of pro-

grams or parts of programs and data for the working store if the operating system is to be able to have a plurality of different subject programs in process simultaneously. For operating systems to use the equipment complement of the entire data processing system most efficiently, operating systems must call for the right mix of programs for movement to working store. The operating system must also call for movement of processed data to auxiliary store. The operating system schedules the running of all programs by maintaining in a list, the order in which programs are to be run and providing for a calling sequence for initiating transfer of information between working and auxiliary stores when needed. Frequently the calling sequence initiates a series of transfers requiring frequent and repeated changes in storage functions, such as storage and retrieval operations of both auxiliary and working stores, to provide for continuous data processing operations.

Generally, control of information movement between working and auxiliary stores in the system described comprises expeditiously transferring data to be processed, data which is the result of processing, and the programs or parts of programs providing the required data processing functions between the working and auxiliary stores and controlling each of the working and auxiliary stores to provide efficient storage and retrieval of the information being transferred. Such control may be effected by one of the peripheral control units. Auxiliary stores normally function as one of a plurality of peripheral devices being controlled by a peripheral control unit.

All data processing operations are performed on operands and words under control of instruction or control words of programs. An operand word represents a unit of information to be processed or information which is the result of processing. An instruction word, hereafter referred to as an instruction, designates a particular operation for the computer to perform. A control word designates a particular type of peripheral device operation or data transfer function for a peripheral control unit to control. Each control word comprises portions called "address fields" which identify specific locations in working and auxiliary stores that contain instruction, control or operand words.

The peripheral control unit gains access to working store locations by means of control words which are stored in working store and transferred to the control unit in response to a computer executing a particular instruction of an operating system calling sequence. Once the control unit receives a control word it performs autonomously to retrieve and execute a succession of additional control words to provide for data transfer operations. The computer is now free to continue with its high speed execution of subject programs.

Prior art peripheral control units provide for transfer of information between stores by controlling the execution of a succession of control words termed data control words. One form of prior art peripheral control unit employs data control words comprising an address field which identifies the specific location in a store that contains the next data control word in the succession.

The form of prior art peripheral control unit which utilizes the previously described address field during retrieval of each next data control word in the succession,